

Case 3660***Antilope arabica* Lichtenstein, 1827 (currently *Gazella arabica*; Mammalia, Ruminantia): proposed conservation of part of the lectotype designated by Neumann (1906)**

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Abstract. The purpose of this application, under Articles 74 and 81 of the Code, is to maintain the usage of the name *Gazella arabica* (Lichtenstein, 1827) for a gazelle from central and southern Arabia. The lectotype designated by Neumann in 1906, consisting of a skull and skin, has been found to be composite and it is proposed that only the skin be retained as the name-bearing specimen. The holotype of *Gazella arabica rueppelli* Neumann, 1906, consisting also of a skull and skin, is also composite and only the skin is now retained as the name-bearing specimen, rendering the name *rueppelli* a junior synonym of *G. gazella* (Pallas, 1766).

Keywords. Nomenclature; taxonomy; Mammalia; Ruminantia; BOVIDAE; *Gazella arabica*; *Gazella arabica rueppelli*; *Gazella gazella*; *Gazella dorcas*; gazelles; central Arabia; southern Arabia.

1. In 1820–1825 the zoologists C.G. Ehrenberg and F.W. Hemprich from the Zoologisches Museum der Königlichen Universität zu Berlin (today the Museum für Naturkunde Berlin) travelled in the Middle East and North Africa. From 1823 to 1826 they periodically sent to the Museum specimens that they had collected. In 1827 the Museum director H. Lichtenstein published a series of booklets setting out recent Museum acquisitions for non-specialist readers. In his second booklet he illustrated (pl. 6) and described (figure caption) a new gazelle species, *Antilope arabica* Lichtenstein, 1827, and noted that it lived on higher ground along the eastern shore of the Red Sea and nearby islands such as Farsan (currently Farasan, about 40 km offshore in south-west Saudi Arabia). He did not designate a type but figured one male and one female individual in life and gave some measurements. He referred to a more detailed manuscript by Hemprich and Ehrenberg, the collectors of the material.

2. In an account of the expedition published shortly afterwards, Hemprich & Ehrenberg (1828, 1833) described the species in detail. Only the plates were published in 1828 and they illustrated (pl. 5) a living male, female and young of '*Antilope arabica*. Sinai'. In a volume delayed in publication, they subsequently (1833) described four specimens with measurements (two males, one female and a subadult female). They noted that the species was collected from valleys in Sinai, deserts along the coast of Arabia and Farasan Island but did not note which specimens came from each locality.

3. None of the documents (Lichtenstein, 1827; Hemprich & Ehrenberg, 1828, 1833) included catalogue numbers for the specimens. In later publications, Neumann (1906) listed only the male (ZMB_MAM_2115) and female (ZMB_MAM_2108) individuals, without mentioning the material of each that was preserved, and Groves (1983, p. 371) listed the male (ZMB_MAM_2115) represented by a skull and skin; an adult female (ZMB_MAM_2108) consisting of a skull and skin, and a juvenile female (ZMB_MAM_2109), said by him to be 'skin only' but a mandible now accompanies it.

4. Letters of Hemprich and Ehrenberg written during the expedition, compiled by Stresemann (1954) and mentioned by Groves (1983), noted that two individuals of *Antilope arabica* were collected on the Sinai peninsula and one on the Farasan archipelago. Groves (1983, p. 372) suggested that the two individuals collected in Sinai were the female and young as their catalogue numbers are consecutive and possibly they were mother and fawn. In 1906 Neumann (p. 245) designated the adult male individual ZMB_MAM_2115 as the type of *Antilope arabica* Lichtenstein, 1827 (a lectotype designation under Article 74.6 of the Code). Neumann (p. 244) stated this to be (in translation) 'an old buck from Farasan island in the Red Sea'. He also designated the female individual ZMB_MAM_2108 as the holotype of a new subspecies from Sinai, *Gazella arabica rueppelli*, to which he referred also some specimens in the Frankfurt Museum from 'Arabia Petraea' collected by Rüppell. Groves selected specimen ZMB_MAM_2108 as the lectotype of *G. a. rueppelli*, apparently unaware that Neumann had fixed the specimen as the holotype.

5. Identification of the supposed specimens in the Berlin museum of *Gazella arabica* using skull measurements and molecular data has proved to be problematic. The horn lengths of the male skull given by Lichtenstein (1827) are identical to our own measurements of ZMB_MAM_2115 (28.9 cm, assuming that 1 inch = 2.53 cm) but the lengths given by Hemprich & Ehrenberg (1833) for the two male specimens are smaller (26.8 cm and 24.0 cm, respectively). In fact most of the measurements (e.g. total length from head to tail, lengths of head, ear and tail) for the male specimen in Lichtenstein (1827) do not match those in Hemprich & Ehrenberg (1833). It could be that Hemprich and Ehrenberg took measurements of some specimens in Arabia and sent another specimen to the museum from the numerous gazelles they shot during their expedition (Hemprich & Ehrenberg, 1833). The horn lengths of the adult female in the two publications are similar (15.2 cm in Lichtenstein, 15 cm in Hemprich & Ehrenberg,). However, both differ from our own measurements (18.4 cm) taken from the putative female syntype skull ZMB_MAM_2108, so we have some doubt about the identity of this skull.

6. Bärmann et al. (2013a) used mitochondrial DNA to investigate the phylogenetic position of the male *G. arabica* lectotype ZMB_MAM_2115. They found that the

skin and skull of the supposed lectotype individual derive from two individuals belonging to two different phylogenetic groups. The skin belongs to the Arabian Mountain gazelles *G. arabica* (cytochrome b and mitochondrial control region), while the skull comes from an individual of the Levantine form of Mountain gazelles, *G. gazella* (Pallas, 1766), a species of which some regard *G. arabica* as a subspecies (mitochondrial control region only was obtained). Bärmann et al. (2013b) also used mitochondrial gene sequences (cytochrome b and control region) to investigate the phylogenetic position of the female *G. arabica rueppelli* holotype ZMB_MAM_2108. The skull is placed by both sequences in *G. dorcas* (Linnaeus, 1758), this being a species widespread in North Africa and extending into Sinai. However, the corresponding skin ZMB_MAM_2108 is placed within *G. gazella* (control region sequence only was obtained). If the female skull ZMB_MAM_2108 is the original skull collected by Hemprich and Ehrenberg there was, as in the case of the male ZMB_MAM_2115, a mistake in assigning skull and skin to the same individual. Another possibility is that the original female syntype skull was accidentally substituted by a *G. dorcas* skull in later years. The difference in skull measurements between the original species description (horn length: 6 inches = 15.2 cm) and the actual specimen (18.4 cm) is striking. Hemprich and Ehrenberg collected six *G. dorcas* females during their expedition (Museum für Naturkunde Berlin, Historische Bild- und Schriftgutsammlungen, SI, Hemprich & Ehrenberg, Blatt 76), so confusion is possible. The juvenile skin ZMB_MAM_2109 is assigned to the same taxon as the *G. arabica* lectotype skin (ZMB_MAM_2115) by the mitochondrial control region sequence.

7. Bärmann et al. (2013b) used principal component analysis (PCA) and discriminant analysis (DA) of linear skull measurements to investigate the similarity of the *G. arabica* lectotype skull ZMB_MAM_2115 to other living gazelle species. In PCA, the first three components, together accounting for approximately 76% of the variability of the data set, placed the specimen in *G. gazella*. However, C4 (accounting for 5% of the variability) shows high similarity with *G. dorcas saudiya* Carruthers & Schwarz, 1935 and *G. cuvieri* (Ogilby, 1841). Skulls of gazelles from Farasan, where the *G. arabica* lectotype skull was said to originate, were not very similar to this skull (Thouless & al Bassri, 1991; Wronski et al., 2010). The discriminant analysis assigned the skull to the Indian species *G. bennettii* (Sykes, 1831), but the distance to the group centroid was very large. Perhaps Groves (1983) was correct in suggesting that the specimen harbours pathological deformations. Another possibility is a hybrid origin, which can also affect skull proportions to a considerable degree (Ackermann et al., 2010). Hybridization is known to occur in captive gazelles (Rebholz & Harley, 1997; Hammond et al., 2001) and, as the origin of the specimen is not known, this cannot be ruled out. The female skull ZMB_MAM_2108 clustered with *G. dorcas* in the PCA, and was assigned to *G. dorcas* in DA. An identity of *G. arabica* was not indicated for the female syntype skull in any of the analyses.

8. One of us (E.V.B.) has checked the original lists of specimens that were shipped to Berlin by Hemprich and Ehrenberg from 1823 to 1826 (Museum für Naturkunde Berlin, Historische Bild- und Schriftgutsammlungen, SI, Hemprich & Ehrenberg, Blatt 113, 126, 182, 188, 189). Three shipments contained specimens that the collectors referred to as *Antilope arabica*:

8th shipment, arrived in May 1824 (with specimens collected in Arabia and Egypt in 1823): one male skull. This skull was probably lost, although it might be one of the specimens measured by Hemprich and Ehrenberg in Arabia.

9th shipment, arrived in April 1825 (with specimens collected in Arabia and Syria in 1824): two skins and one skeleton. These could be the skins ZMB_MAM_2115 (probably from Arabia) and ZMB_MAM_2108 (probably from Syria). The skull ZMB_MAM_2115 (probably also from Syria) could be the skull belonging to the skeleton from the same shipment, which would account for the erroneous assumption that it belongs to the male skin. The rest of the skeleton is most likely lost as it was never mentioned again.

10th shipment, arrived in April 1826 (with specimens collected in Arabia and Abyssinia in 1825); one adult and one juvenile individual (parts not specified). The juvenile must be ZMB_MAM_2109, skin and mandible, probably from Arabia or Farasan Island. The adult from the same shipment might be the skull ZMB_MAM_2108, probably from Abyssinia, or the original specimen was lost and erroneously replaced by ZMB_MAM_2108.

9. Using the information given in paras. 5–8 above, the three specimens listed by Groves (1983, para. 3 above) can be annotated as follows:

ZMB_MAM_2115 Old male skull of *G. gazella* and skin of *G. arabica* (9th shipment). Both specimens constitute the present lectotype of *G. arabica* (Lichtenstein, 1827).

ZMB_MAM_2108 Adult female *G. dorcas* skull (10th shipment, probably from Abyssinia), and *G. gazella* skin (9th shipment, probably from Syria). Both specimens constitute the holotype of *G. arabica rueppelli* Neumann, 1906. The skin has an identical mitochondrial sequence to the skull of ZMB_MAM_2115.

ZMB_MAM_2109 Juvenile female *G. arabica* skin, not mentioned by Neumann in 1906 (10th shipment, plus a mandible). The skin is conspecific with the skin of ZMB_MAM_2115.

In the recent past Masseti (2010, pp. 361–362) has noted that the specimen ZMB_MAM_2115 (skull and skin) of *G. arabica* collected in 1825 is enigmatic, with a doubtful provenance and the likelihood of human error concerning its origin.

10. Article 73.1.5 of the Code allows parts of a holotype later found to be composite to be excluded by a subsequent author. By the time of a lectotype designation, however, any extraneous elements in the syntype series are supposed to have been removed and a single (non-composite) specimen becomes the name-bearer (Article 74). The lectotype of *Gazella arabica* (Lichtenstein, 1827) consists of a skull and skin which have been shown to belong to different individuals and, indeed, to different species. To conserve the current understanding and usage of the name *G. arabica* for the gazelle of central and southern Arabia we propose that the type status of the skull of ZMB_MAM_2115, a specimen of *G. gazella*, be set aside and that the skin of ZMB_MAM_2115, a specimen of *G. arabica*, be maintained as the sole name-bearing specimen. In the case of the holotype of *Gazella arabica rueppelli* Neumann, 1906, which has also been found to be composite, the skull of ZMB_MAM_2108 is a specimen of *G. dorcas* with an uncertain provenance (para. 5 above). We therefore exclude this skull from the holotype of *G. a. rueppelli* and retain the skin of ZMB_MAM_2108, a specimen of *G. gazella*, as the name-bearing specimen. Consequently, the name *G. arabica rueppelli* becomes a junior synonym of



Fig. 1. Skin of the lectotype of *Gazella arabica* (Lichtenstein, 1827) showing the characteristic dark nasal spot. Photographs: Carola Radke, Museum für Naturkunde Berlin.

G. gazella. Pocock (1935, p. 460) previously suggested that *G. a. rueppelli* was a synonym of *G. gazella gazella*; Groves (1983) thought that *G. a. rueppelli* was a synonym of *G. dorcas isabella* Gray, 1846.

11. The lectotype skin ZMB_MAM_2115 shows characters which largely agree with those of *Gazella arabica* and differ from *G. dorcas*. This latter species occurs in many areas visited by Hemprich and Ehrenberg, specimens of it were described by Lichtenstein (1827), and it is the most likely alternative identification for the Berlin material. According to Lichtenstein, *G. arabica* is the size of a European roe deer *Capreolus capreolus* (Linnaeus, 1758), generally darker in colour than *G. dorcas*, with a fairly large dark spot on the muzzle tip, a black stripe from the eye to the corner of the mouth and a black tail which is brown only at the base. There are conspicuous knee tufts [on the front legs] in both sexes. The black nasal spot is clearly visible from an early age. In designating the lectotype of *G. arabica*, Neumann (1906) noted that the species had no dark side stripe and no greyish tone to the strongly reddish body colour. The lectotype skin ZMB_MAM_2115 seen by all authors in Berlin shows an overall colouring that is not more reddish or less sandy than in *G. dorcas*, but it does have a dark nasal spot and eye stripes which differ from the rufous central face stripe of *G. dorcas*. There is a wide and light mid-flank band, not as light as in many *G. dorcas*, which extends to the rear to a level just above the front of the back legs (a short way in front of the pygal band). Below is a slightly darker and less wide flank band which is no darker than the top of the back (which some might see as a difference from *G. dorcas*) but with a greyer tinge in its colouring than the area more dorsally. The pygal band is a darker brown than the brown in front of it going forward to the back of the lighter flank band. The skin has very slightly darkened carpal tufts (probably not different from *G. dorcas*) and tufts of dark brown fur above the hooves on the front legs (there has been hair loss from the back legs). These morphological characters are in accord with the understanding of *Gazella arabica* from southern Arabia in both the older and more modern literature (see, for example, Wagner, 1844, p. 407; Sclater & Thomas, 1898, pp. 115–118, pl. 59; Anderson & de Winton, 1902, pp. 342–343; Lydekker & Blaine, 1914, pp. 57–59; Flower, 1932, p. 438; Pocock, 1935, pp. 458–462; Morrison-Scott, 1939, p. 185; Harrison, 1968, pp. 350–353; Lange, 1972, p. 227; Kingdon, 1990, p. 141; Lerp et al., 2014).

12. The International Commission on Zoological Nomenclature is accordingly asked:

- (1) to use its plenary power to set aside the lectotype status of the skull ZMB_MAM_2115 in the Museum für Naturkunde Berlin of *Antilope arabica* Lichtenstein, 1827, retaining only the skin ZMB_MAM_2115 as the sole lectotype specimen;
- (2) to place on the Official List of Specific Names in Zoology the name *arabica* Lichtenstein, 1827, as published in the binomen *Antilope arabica* and as defined by the lectotype skin ZMB_MAM_2115 in the Museum für Naturkunde Berlin designated by Neumann (1906), as ruled in (1) above.

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- Acknowledgement of receipt of this application was published in BZN **71**: 68.

Comments on this case are invited for publication (subject to editing) in the *Bulletin*; they should be sent to I.C.Z.N. Secretariat, Natural History Museum, Cromwell Road, London SW7 5BD, U.K. (e-mail: iczn@nhm.ac.uk).